Air Quality Monitoring in Response to a fire at the Tsuu T'ina First Nation Landfill

Alberta

ISBN No. 978-1-4601-0435-4 (Printed Edition)
ISBN No. 978-1-4601-0436-1 (On-Line Edition)
June, 2012

1. *Introduction*

The Tsuu T'ina First Nation operates a landfill on its reserve, which is located adjacent to the southwest boundary of the City of Calgary. The landfill is known to handle construction and demolition materials. A fire occurred at the Tsuu T'ina landfill site from February 8th to February 10th, 2012.

To address air quality concerns from the landfill fire, Alberta Environment and Sustainable Resource Development (ESRD) deployed the Mobile Air Monitoring Laboratory (MAML) to the area in the afternoon of February 8th. The MAML detected elevated levels of fine particulate matter ($PM_{2.5}$), which can be primarily attributed to smoke from the landfill fire, where the 1-hour $PM_{2.5}$ Alberta Ambient Air Quality Guideline (AAAQG) was exceeded for 10 hours on both February 8th and 9th.

A portable monitor for measuring fine particulate matter continuously, called an Environment Beta Attenuation Monitor (E-BAM), was also deployed in response to the fire. Fine particulate matter refers to particles with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$). Exceedances of the 1-hour AAAQG for $PM_{2.5}$ were also observed at this instrument location on February 8th and 9th.

One volatile organic compound (VOC) sampling canister was deployed at the fire location on February 8th. Based on the analytical results of the canister sample, there is no reason to suspect that abnormal (relative to landfill fires) VOC emissions were present.

2. *Monitoring methods and location*

The MAML was deployed to the area from February 8th, 2012 to February 10th, 2012. It conducted monitoring at 9 sites within an approximate radius of 7 kilometres to the fire, including locations on the Tsuu T'ina Nation lands as well as at various locations in southwest Calgary. The MAML started monitoring at approximately 5:30 PM on February 8th and completed monitoring the morning of February 10th.

The E-BAM was set up in a residential back yard in the southwest community of Woodbine, City of Calgary. The residence was located approximately 2.5 kilometres east of the fire. The E-BAM had a satellite uplink which allowed for real time updates over the internet. The portable particulate monitor collected data from February 8th to 21st.

An evacuated volatile organic compound (VOC) sampling canister was deployed at the land fill site at approximately 5:30 PM on February 8th for the duration of 1-hour. The canister contents were analyzed by the trace organics laboratory at Alberta Innovates Technologies Futures in Vegreville, Alberta. This VOC sample was taken to determine if there were unexpected compounds in the air from the landfill fire emissions.

Monitoring locations are indicated in Figure 1 and a description of each site is given in Table 1.

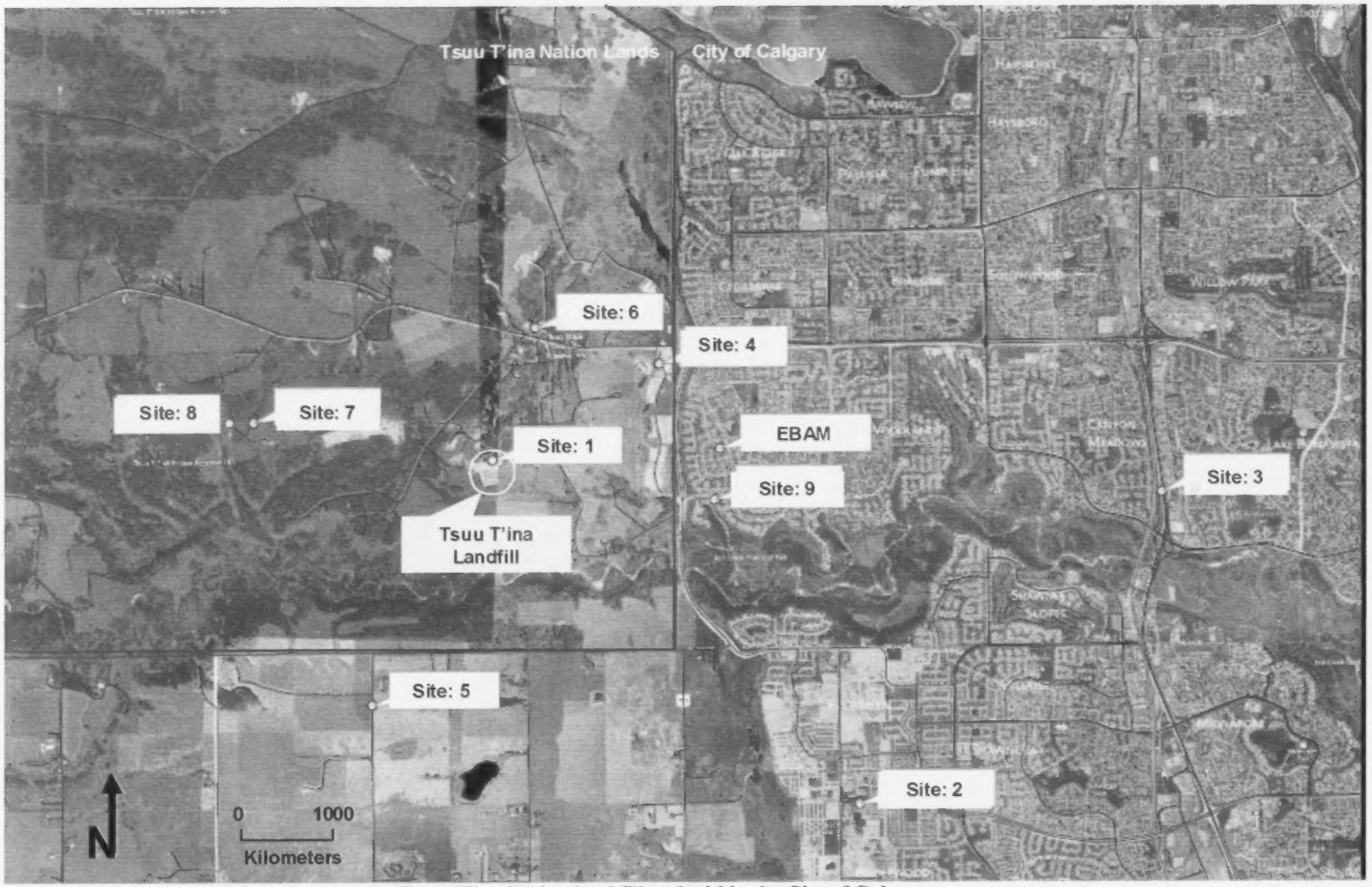

Figure 1: Map of monitoring sites near the Tsuu T'ina Nation land fill and within the City of Calgary.

Table 1: Description of monitoring sites near the Tsuu T'ina Nation land fill and the City of Calgary.

Site #	Location	Description
1	50.9397, -114.1683	Tsuu T'ina Landfill – location of fire, MAML and VOC canister monitoring site
2	50.9064, -114.1143	Fire Station 36 in community of Bridlewood (City of Calgary),MAML monitoring site
3	50.9359, -114.0689	East of landfill, McLeod Trail S, near South Centre Mall (City of Calgary), MAML monitoring site
4	50.9488, -114.1433	Northeast of landfill, Council building, Tsuu T'ina Nation lands, MAML monitoring site
5	50.9464, -114.1865	South of landfill, rural location, MAML monitoring site
6	50.9524, -114.1617	North of landfill, Tsuu T'ina Nation lands, MAML monitoring site
7	50.9436, -114.2037	West of landfill, Tsuu T'ina Nation lands, MAML monitoring site
8	50.9436, -114.2073	West of landfill, Tsuu T'ina Nation lands, MAML monitoring site
9	50.9357, -114.1353	East of landfill, Fish Creek Park entrance (City of Calgary), MAML monitoring site
EBAM	50.3906, -114.1344	Portable particulate monitor, Woodbine resident's backyard, (City of Calgary)

3. *Summary of findings*

3.1. Meteorological Conditions

Meteorological conditions were examined to better understand conditions affecting the local vicinity for the period of time that the fire was active. The wind conditions at the Calgary International Airport weather station (Figure 2) indicated relatively moderate to strong winds. Whereas the Calgary NW Air Monitoring Station (Figure 3) indicated calmer conditions, which is better aligned with observations from on-site air monitoring staff during the fire. Thus, the meteorological conditions observed at the Calgary NW Air Monitoring Station are likely to be more representative of conditions experienced at the Tsuu T'ina fire.

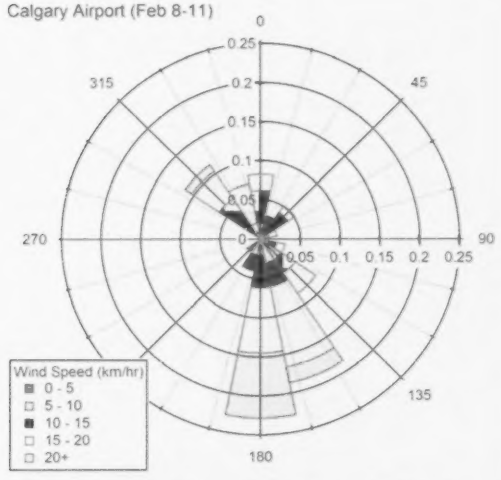

Figure 2: Calgary International Airport Wind Rose
(February 8-11, 2012)

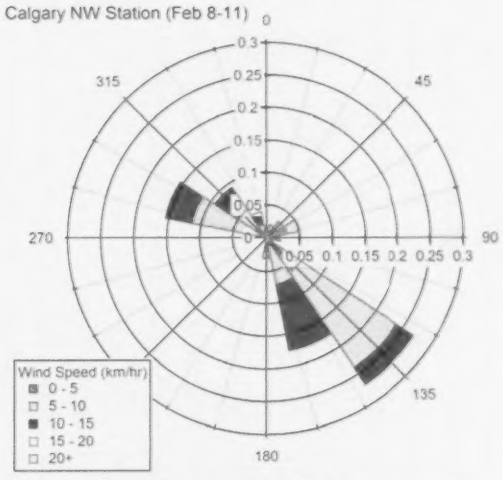

Figure 3: Calgary NW Air Monitoring Station Wind Rose
(February 8-11, 2012)

Twelve hour wind roses from February 8th through February 10th for the Calgary NW Station are shown in Figures 4a through 4f, inclusive.

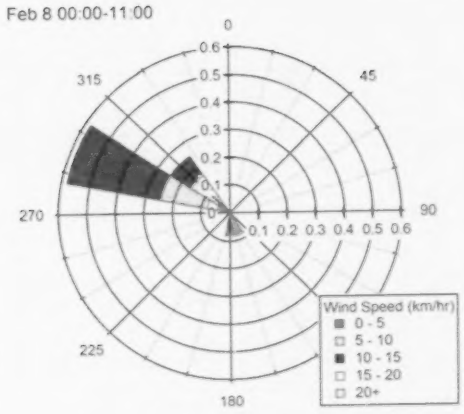

Figure 4a: Calgary NW Wind Rose
(February 8: 12:00 AM to 11:00 AM)

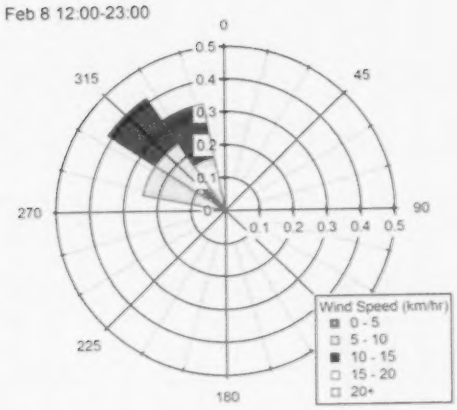

Figure 4b: Calgary NW Wind Rose
(February 8: 12:00 PM to 11:00 PM)

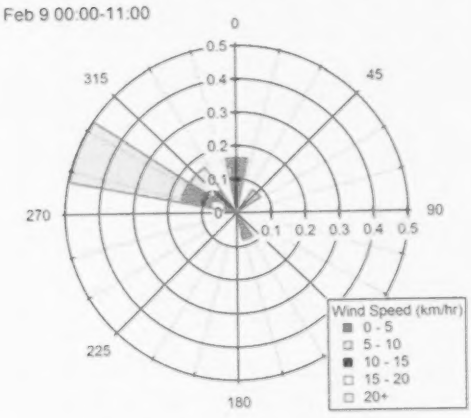

Figure 4c: Calgary NW Wind Rose
(February 9: 12:00 AM to 11:00 AM)

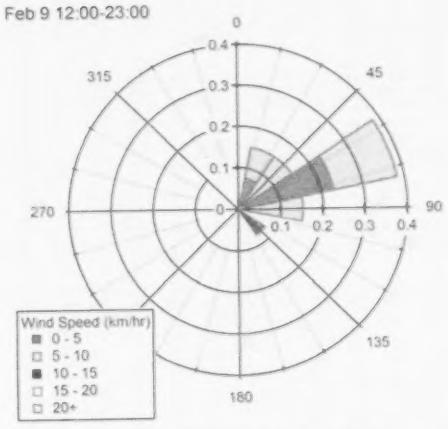

Figure 4d: Calgary NW Wind Rose
(February 9: 12:00 PM to 11:00 PM)

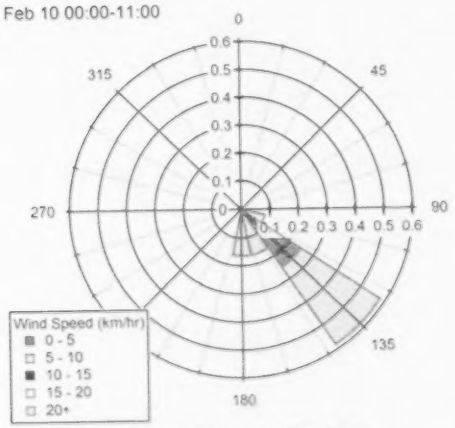

Figure 4e: Calgary NW Wind Rose
(February 10: 12:00 AM to 11:00 AM)

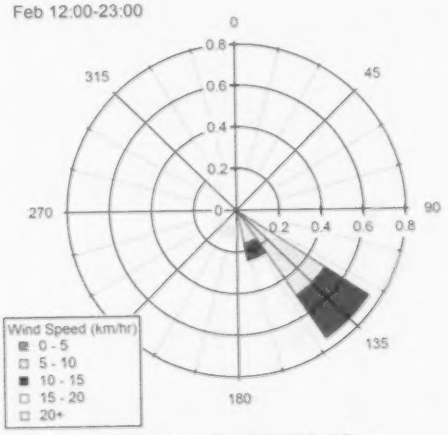

Figure 4f: Calgary NW Wind Rose
(February 10: 12:00 PM to 11:00 PM)

Figure 4a and Figure 4b indicate that, for February 8th, predominant winds were from the west-northwest and north-northwest with moderate wind speeds. It is likely that the smoke plume from the fire, on February 8th, would have travelled southeast of the land fill site. Figure 4c and Figure 4d indicate that winds were relatively calm on February 9th, which may have lead to stagnant conditions and poor dispersion of the smoke plume, which would result in lingering smoke throughout southwest Calgary.

Figure 5 provides an alternate format to examine the wind speed and wind direction measured at the Calgary NW station from February 8th through February 10th. The majority of winds were from the north-northwest for February 8th and February 9th. Wind speeds were low on the morning of February 9th and became moderate later in the day.

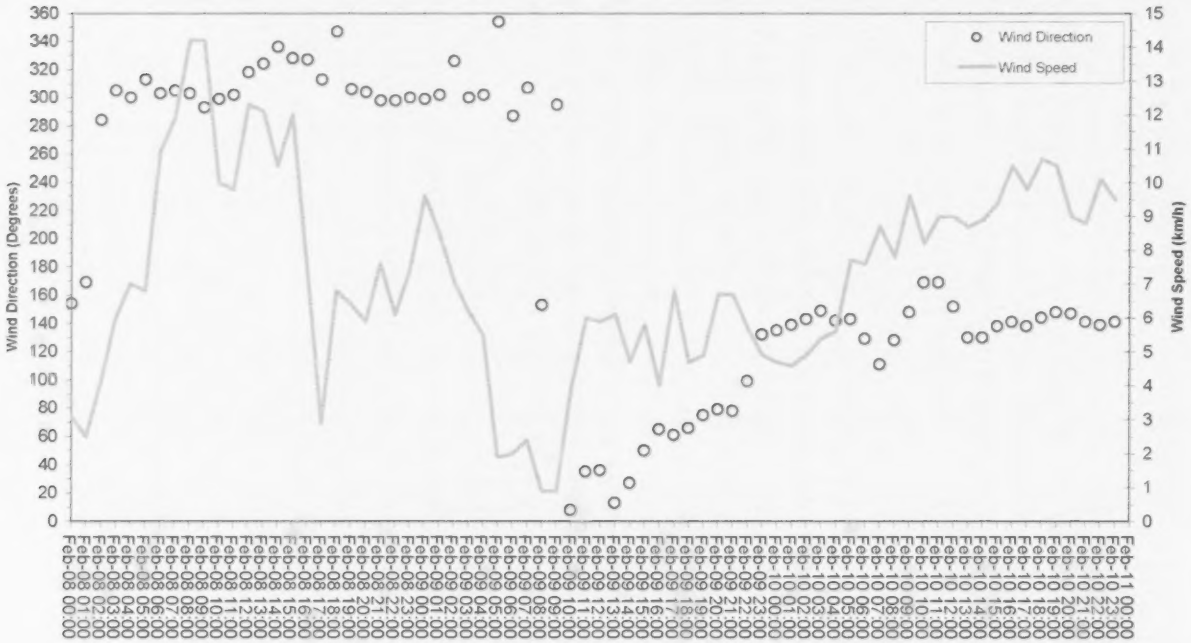

Figure 5: Wind speed and wind direction at the Calgary NW station during the Tsuu T'ina Landfill Fire for February 8th through February 10th.

3.2. MAML Data

The MAML measures a variety of pollutants including, criteria air contaminants, reduced sulphurs, hydrocarbons, particulates, polycyclic aromatic hydrocarbons (PAH) and meteorological conditions. The pollutants of interest during this event were those commonly associated with the combustion of construction material. The primary emission of concern is $PM_{2.5}$ in the form of smoke plumes from the burn site. The average 1-hour concentrations for $PM_{2.5}$ monitored by the MAML are presented in Table 2 for each of the dates that data were collected. These concentrations were compared to Alberta Ambient Air Quality Guidelines (AAAQG).

February 8th:

One exceedance of the AAAQG was measured at the landfill site directly adjacent to the fire at 5:30 pm. At this time, the wind direction was from the east-southeast with a speed of about 5 kilometres per hour, which places the sample site directly in the plume at the landfill. During this time, the MAML was able to measure directly adjacent to the fire. Elevated levels of carbon monoxide (CO) and nitrogen dioxide (NO_2) were also measured, but concentrations were below the Alberta Ambient Air Quality Objectives (AAAQO); CO and NO_2 are commonly associated with combustion activity. The MAML re-located to Site #2, Fire Station 36, and remained there until the next morning.

February 9th:

At 1:00 AM on Site #2, the winds shifted west-northwesterly, resulting in the MAML being directly downwind from the fire and a rise in measured $PM_{2.5}$ concentrations. This indicates that elevated $PM_{2.5}$ concentrations during this period of time were likely associated with the landfill fire. At 8:30 AM, the MAML was relocated to Site #3, located approximately 7 kilometres east of the landfill, where $PM_{2.5}$ exceeded the AAAQG. At the time of the Site #3 exceedance, the wind was from south-southwest with a speed of about 2 kilometres per hour. This indicates that the measurement was not directly downwind at that time; however, the low wind speed conditions may have led to poor dispersion of the smoke plume; hence, elevated concentrations over the southwest part of the city. Elevated levels of CO and NO_2 were also measured at Site #3, but that can be partially attributed to Site #3 being located next to a major roadway.

From 11:00 AM to 9:00 PM, the MAML took measurements at Site #4, Site #5, Site #6, Site #7, and Site #8. Elevated levels of $PM_{2.5}$ were measured at these sites, even when the MAML was not positioned directly downwind of the fire. The highest $PM_{2.5}$ measurement took place at 4:00 PM at Site #7, where the MAML was directly downwind of the fire. Data at Site #9 was only collected for 30 minutes.

February 10th:

The MAML remained at Site #2 overnight, where slightly elevated levels of $PM_{2.5}$ were measured, even when the MAML was upwind of the fire. This indicates that the smoke from the fire continued to have an effect on the southwest part of Calgary, even when the fire itself was put under control. The MAML returned to Site #1 at 10:00 AM, where elevated levels of $PM_{2.5}$ were detected, but well below the concentrations measured on February 8th and 9th. Elevated levels of CO and NO_2 were again detected.

Table 2: Summary of data from continuous monitoring collected by the MAML during the Tsuu T'ina Landfill Fire.

Tsuu T'ina Landfill Fire MAML Survey (Feb. 8, 2012 to Feb. 10, 2012)

Site #	Date:	Start/End Times:	PAH	PM10	PM2.5	PM1	CO	NO	NO2	NOx	O3	NH3	SO2	TRS	H2S	THC	CH4	NMHC	Temp	RH	WSP	WDR
			ng/m³	µg/m³			ppm						ppm			ppm			°C	%	km/h	DEG
Applicable 1-hr AAAQO				-	80	-	13.000	-	159	-	82	2.000	172	-	10	-	-	-	-	-	-	-
1	08-Feb-12	17:31 to 18:32	13.900	509.000	176.300	99.900	1.100	0.068	0.040	0.101	0.025	0.014	0.000	0.003	0.003	1.900	1.900	0.000	3.3	25.4	4.6	120.0
2	08-Feb-12	20:59 to 21:59	ND	71.600	17.700	8.900	0.200	0.003	0.014	0.016	ND	0.000	0.001	ND	0.000	1.800	1.800	0.000	-3.3	45.0	3.3	256.0
2	08-Feb-12	21:59 to 22:59	ND	40.300	10.900	5.600	0.200	0.001	0.014	0.013	ND	0.000	0.000	ND	0.000	1.800	1.800	0.000	-4.2	48.9	3.2	242.0
2	08-Feb-12	22:59 to 23:59	ND	28.600	7.500	4.100	0.200	0.000	0.010	0.010	ND	0.000	0.000	ND	0.000	1.800	1.800	0.000	-4.1	49.3	4.0	254.0
2	09-Feb-12	00:00 to 00:59	ND	20.000	5.200	2.700	0.200	0.000	0.007	0.005	ND	0.000	0.000	ND	0.000	1.800	1.800	0.000	-4.0	52.6	10.2	293.0
2	09-Feb-12	00:59 to 01:59	ND	55.000	42.700	29.700	0.400	0.000	0.006	0.005	ND	0.000	0.000	ND	0.000	1.800	1.800	0.000	-3.0	49.6	9.8	299.0
2	09-Feb-12	01:59 to 02:59	ND	42.000	31.700	23.400	0.300	0.001	0.009	0.009	ND	0.000	0.001	ND	0.001	1.800	1.800	0.000	-2.2	44.2	5.7	317.0
2	09-Feb-12	02:59 to 03:59	ND	25.900	18.300	14.500	0.300	0.002	0.013	0.014	ND	0.000	0.001	ND	0.001	1.800	1.800	0.000	-4.7	54.3	4.0	252.0
2	09-Feb-12	03:59 to 04:59	ND	13.200	6.100	4.600	0.200	0.002	0.012	0.012	ND	0.000	0.002	ND	0.001	1.800	1.800	0.000	-6.4	65.0	3.4	266.0
2	09-Feb-12	04:59 to 05:59	ND	26.900	7.300	4.900	0.300	0.005	0.017	0.020	ND	0.000	0.003	ND	0.001	1.800	1.800	0.000	-6.6	66.3	3.6	233.0
2	09-Feb-12	05:59 to 06:59	ND	97.200	19.700	9.900	0.700	0.026	0.037	0.061	ND	0.000	0.002	ND	0.002	2.100	1.900	0.200	-7.5	71.5	2.4	236.0
3	09-Feb-12	08:37 to 09:38	11.400	292.600	144.100	91.300	2.200	0.086	0.049	0.132	0.008	0.000	0.007	0.004	0.004	2.200	2.200	0.000	-5.1	60.4	1.9	189.0
3	09-Feb-12	09:38 to 10:38	3.200	141.700	52.500	35.300	1.000	0.043	0.039	0.080	0.005	0.002	0.005	0.002	0.002	2.100	2.100	0.000	-3.6	57.1	3.6	146.0
4	09-Feb-12	11:44 to 12:45	1.600	97.000	37.400	27.300	0.600	0.030	0.035	0.062	0.005	0.001	0.017	0.002	0.002	2.000	2.000	0.000	-1.0	51.0	4.6	121.0
5	09-Feb-12	13:34 to 14:35	1.100	80.800	32.400	25.100	0.400	0.012	0.020	0.030	0.014	0.000	0.019	0.001	0.001	1.900	1.900	0.000	1.8	42.9	4.6	124.0
6	09-Feb-12	14:59 to 15:31	0.900	75.000	31.600	25.100	0.600	0.015	0.026	0.039	0.008	0.001	0.019	0.001	0.002	1.900	1.900	0.000	0.2	48.7	7.8	159.0
7	09-Feb-12	16:04 to 17:05	1.900	398.000	57.100	21.400	0.300	0.008	0.022	0.027	0.008	0.000	0.008	0.001	0.001	1.900	1.900	0.000	-0.7	53.7	8.2	106.0
7	09-Feb-12	17:20 to 18:20	1.800	98.400	31.700	20.500	0.400	0.004	0.018	0.019	0.006	0.000	0.007	0.001	0.001	1.900	1.900	0.000	-4.2	68.2	4.3	95.0
8	09-Feb-12	19:49 to 20:20	1.000	75.800	28.600	22.000	1.500	0.014	0.019	0.030	0.003	0.004	0.004	0.001	0.000	2.200	2.100	0.100	-5.9	76.8	2.2	154.0
2	09-Feb-12	21:59 to 22:59	ND	36.800	24.500	18.700	0.400	0.002	0.015	0.016	ND	0.001	0.000	ND	0.000	2.100	2.000	0.100	-9.1	85.5	8.2	90.0
2	09-Feb-12	22:59 to 23:59	ND	32.200	21.700	17.500	0.300	0.001	0.010	0.010	ND	0.001	0.000	ND	0.000	2.100	2.000	0.100	-9.5	88.3	7.3	117.0
2	10-Feb-12	00:00 to 00:59	ND	27.000	18.700	15.800	0.300	0.004	0.013	0.015	ND	0.000	0.000	ND	0.000	2.000	2.000	0.000	-9.5	89.2	6.2	131.0
2	10-Feb-12	00:59 to 01:59	ND	18.500	13.600	11.900	0.300	0.000	0.009	0.008	ND	0.001	0.000	ND	0.000	2.000	2.000	0.000	-9.9	91.0	6.0	97.0
2	10-Feb-12	01:59 to 02:59	ND	17.600	13.300	11.700	0.200	0.000	0.008	0.007	ND	0.001	0.000	ND	0.000	2.100	2.100	0.000	-10.6	93.3	6.0	109.0
2	10-Feb-12	02:59 to 03:59	ND	18.200	13.700	12.000	0.300	0.002	0.010	0.009	ND	0.000	0.000	ND	0.000	2.200	2.200	0.000	-11.1	95.6	5.7	115.0
2	10-Feb-12	03:59 to 04:59	ND	18.600	14.100	12.500	0.200	0.001	0.011	0.010	ND	0.000	0.000	ND	0.000	2.100	2.100	0.000	-11.3	96.7	7.1	98.0
2	10-Feb-12	04:59 to 05:59	ND	21.100	15.500	13.300	0.300	0.006	0.013	0.018	ND	0.002	0.000	ND	0.001	2.100	2.100	0.000	-11.1	95.2	8.3	114.0
2	10-Feb-12	05:59 to 06:59	ND	20.700	16.900	15.500	0.300	0.006	0.013	0.017	ND	0.001	0.000	ND	0.001	2.400	2.200	0.200	-11.3	95.9	9.9	107.0
1	10-Feb-12	09:50 to 10:55	22.900	43.800	33.400	27.400	2.500	0.198	0.065	0.233	0.003	0.039	0.002	0.003	0.003	3.000	2.700	0.300	-11.0	90.0	11.0	191.0

Data has not been fully QA/QC'd	nanograms per cubic metre (ng/m^3)	micrograms per cubic metre (mg/m^3)	parts per million (ppm)
Polycyclic Aromatic Hydrocarbons (PAH)	Particulate Matter of Aerodynamic Diameter < 10 um (PM_{10})	Particulate Matter of Aerodynamic Diameter < 2.5 um ($PM_{2.5}$)	Particulate Matter of Aerodynamic Diameter < 1 um (PM_1)
Carbon Monoxide (CO)	Nitric Oxide (NO)	Nitrogen Dioxide (NO_2)	Total Oxides of Nitrogen (NO_x)
Ozone (O_3)	Ammonia (NH_3)	Sulphur Dioxide (SO_2)	Total Reduced Sulphurs (TRS)
Hydrogen Sulphide (H_2S)	Total Hydrocarbons (THC)	Methane (CH_4)	Non-Methane Hydrocarbons (NMHC)
Temperature (Temp)	Percent Relative Humidity (RH)	Wind Speed (WSP)	Wind Direction (WDR)

3.3. E-Bam Data

The average 1-hour concentrations for $PM_{2.5}$ were also monitored by the E-BAM; located in the backyard of a City of Calgary resident. These concentrations were compared to the 1-hour $PM_{2.5}$ Alberta Ambient Air Quality Guidelines (AAAQG) of 80 micrograms per cubic metre. Figure 6 shows a summary of the $PM_{2.5}$ monitoring data (E-BAM, Calgary NW and Calgary Central) compared to wind speeds at the Calgary NW station for the corresponding time period. Since the E-BAM monitor was located in a fenced yard, the wind speed and wind direction are not representative of meteorological conditions at the fire site.

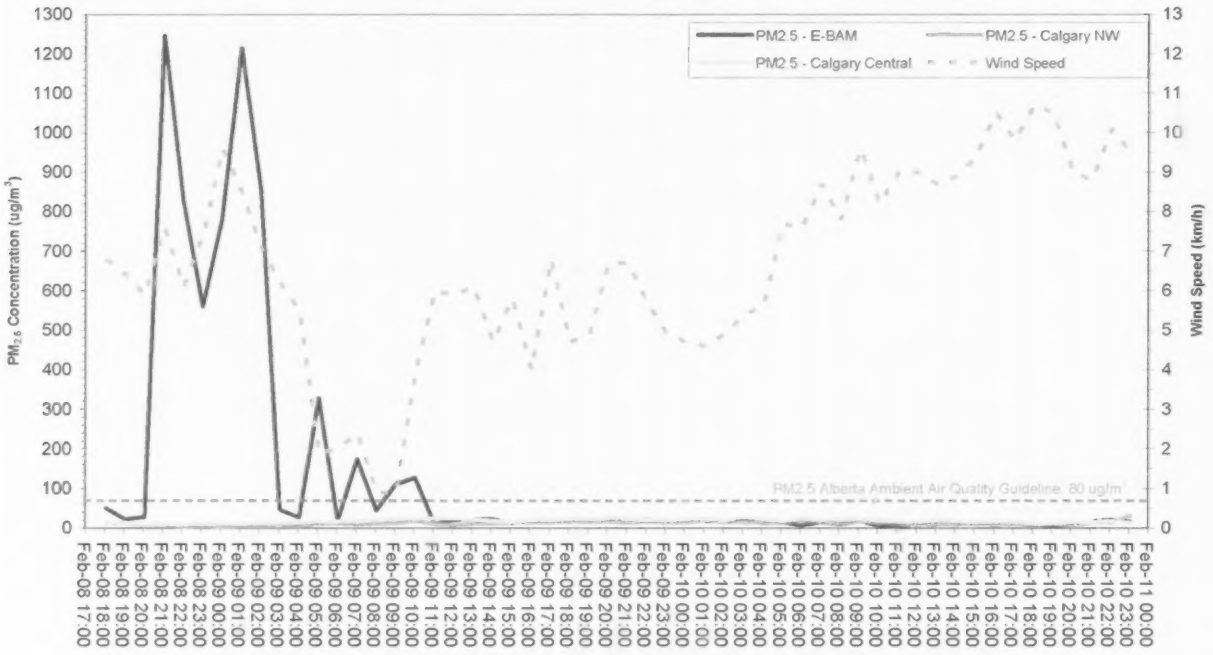

Figure 6: Summary of E-BAM $PM_{2.5}$ monitoring data and wind speed at the Calgary NW and Calgary Central stations during the Tsuu T'ina Landfill Fire

The maximum 1-hour concentrations indicate that exceedances of the AAAQG were measured on February 8th and February 9th. The AAAQG was exceeded for 10 hours on that day, where concentrations ranged from 560 to 1246 micrograms per cubic metre between 9:00 PM on February 8th and 2:00 AM on February 9th. Based on corresponding wind speed and wind direction data, from the Calgary NW monitoring station, the exceedances occurred when prevailing winds were from the west-northwest to northwest. The landfill fire was located directly west of the E-BAM, based on the prevailing winds of west-northwest, the E-BAM may have not have been located at the maximum point of impact.

At approximately 2:00 AM the wind speeds began to decrease and the $PM_{2.5}$ concentrations significantly dropped. This decrease in $PM_{2.5}$ concentrations coincided with a decrease in wind speed, possibly indicating, that the fire subsided with less fuel from the winds or the fire was being better controlled. Elevated concentrations and three exceedances of the 1-hour $PM_{2.5}$ AAAQG were observed between 5:00 AM and 9:00 AM, but were significantly lower than those observed earlier that morning. The winds at that time can be described as calm.

No exceedances of the 1-hour AAAQG for $PM_{2.5}$ were measured from February 10th through February 21st and concentrations generally decreased with time. This supports the assumption (at the time) that the fire was under-control or suppressed by that time.

Through the period of time indicated in Figure 6, $PM_{2.5}$ concentrations at the Calgary NW and Calgary Central stations remained consistent and below the AAAQG. This indicates that central and north Calgary were not heavily affected by the fire. Overall, the observed measurements are considered representative of air quality effects on adjacent neighbourhoods from the landfill fire.

3.4. VOC Canister Data

In addition to the continuous monitoring discussed above, one integrated volatile organic compound (VOC) sampling canister was deployed at Site #1 on February 8th 5:37 PM for one hour. The measured VOC concentrations are presented in Table 3.

Urban (Calgary Central Station) baseline VOC 24-hour concentrations and Alberta Ambient Air Quality Objectives (AAAQO) were used as a reference to the VOC canister sampled at Site #1. Although the canister taken for this study was a 1-hour sample, a conservative comparison can still be made with the 24-hour reference VOC concentrations. There were no exceedances of the AAAQO, but elevated concentrations of benzene and toluene were measured. In urban environments benzene and toluene are commonly associated with transportation emissions, but in this case the elevated concentrations may have also been from combustion of biomass or synthetic materials. Heavy equipment vehicles (fire fighting trucks, excavators etc.) were also in the vicinity of the sampling site, and could have had an impact on the VOC concentrations in the sample.

Based on the analytical results of the canister sample taken at the landfill fire; there is no reason to suspect that abnormal (relative to landfill fires) VOC emissions were present.

Table 3: VOC Canister Sample Results

Tsuu T'ina Landfill Fire - VOC Canister Results					
NAME	Unit	AAAQO[1]	TCEQ[2]	Baseline[3]	16-Jan-12
		1 hour	Short Term	2010	T12-0217
Target Compounds[4]					
Hydrogen sulphide	ppbv	10			0.100
Carbonyl sulphide	ppbv		55		0.940
Freon-12	ppbv		10000	0.526	0.158
Isobutane	ppbv		2040	0.890	1.000
1-Butene	ppbv		360	0.136	1.950
Butane	ppbv		10000	1.805	2.310
Ethanol	ppbv		10000		1.710
Isopentane	ppbv		1200	0.820	0.767
Freon-11	ppbv		5000	0.299	0.268
1-Pentene	ppbv		100	0.022	0.186
Acetone	ppbv	2400	2500		5.670
Freon-113	ppbv		5000	0.077	0.084
Methylene chloride	ppbv		75		0.001
2,3-Dimethylbutane	ppbv			0.034	0.040
2-Methylpentane	ppbv		83	0.151	0.140
3-Methylpentane	ppbv		1000	0.112	0.067
1-Hexene	ppbv		20	0.014	0.161
Hexane	ppbv	5960	1500	0.153	0.165
Methylcyclopentane	ppbv		750	0.082	0.064
2,4-Dimethylpentane	ppbv			0.034	0.034
Benzene	ppbv	9	54	0.185	1.520
Carbon tetrachloride	ppbv		20	0.087	0.065
2,2,4-Trimethylpentane	ppbv		750	0.022	0.046
Trichloroethylene	ppbv		100	0.006	0.123
Heptane	ppbv		850	0.069	0.074
Toluene	ppbv	499	170	0.628	1.020
Octane	ppbv		750	0.019	0.127
Tetrachloroethylene	ppbv		300	0.062	0.176
Chlorobenzene-d5	ppbv			0.002	0.001
Ethyl benzene	ppbv	460	170	0.070	0.305
m,p-Xylene	ppbv	529		0.251	0.223
Styrene	ppbv	52	25	0.012	0.550
o-Xylene	ppbv	529	380	0.084	0.119
Nonane	ppbv		2000	0.019	0.045
Isopropylbenzene	ppbv		100	0.006	0.061
m-Ethyltoluene	ppbv		250	0.015	0.072
Decane	ppbv		1750	0.025	0.046
1,2,4-Trimethylbenzene	ppbv		250	0.065	0.070
Undecane	ppbv		500	0.024	0.039
1,2,4-Trichlorobenzene	ppbv		50	0.002	0.033
Naphthalene	ppbv		90	0.020	0.695
Non-Target Compounds[5]					
Acetophenone	ppbv				0.187
Phenol	ppbv	26	40		0.304
.alpha.-Methylstyrene	ppbv		50		0.169
Benzene, 1-ethyl-4-methyl-	ppbv		250		0.215
Total	ppbv				22.100

[1] AAAQO = Alberta Ambient Air Quality Objective

[2] TCEQ = Texas Commission on Environmental Quality

[3] 2010 Environment Canada National Air Pollution Surveillance VOC 24h Averages from Calgary Central

[4] Targeted compounds in laboratory analysis

[5] Non-targeted compounds that are determined through electronic library lookup

4. *Summary*

In response to a landfill fire at the Tsuu T'ina First Nation, Alberta Environment and Sustainable Resource Development (ESRD) conducted ambient air quality monitoring to assess the potential impact on local air quality. ESRD deployed three different monitoring components. The Mobile Air Monitoring Laboratory (MAML) monitored from the evening of February 8th to the morning of February 10th at various surrounding locations. An E-BAM unit was set up in a City of Calgary resident's yard and monitored $PM_{2.5}$ from February 8th through 21st. An integrated volatile organic compound (VOC) sampling canister was deployed for one hour at the fire site on the evening of February 8.

Both the MAML and the E-BAM monitoring units observed exceedances of the 1-hour Alberta Ambient Air Quality Guidelines (AAAQG) for $PM_{2.5}$ on February 8th and 9th. Exceedances measured by the MAML were experienced when the unit was stationed directly downwind from the fire. An exceedance was also recorded when the unit was not directly downwind; however, the low wind speed conditions may have led to poor dispersion of the smoke plume. Elevated levels of $PM_{2.5}$ were measured at several of the sites, but gradually decreased with time As the fire was brought under control and eventually extinguished.

At the E-BAM site, the AAAQG was exceeded for 10 hours with concentrations ranging from 560 to 1246 microgram per cubic metre on February 8th and 9th. Based on corresponding wind speed and wind direction data, from the Calgary NW monitoring station, the exceedances occurred when prevailing winds were from the west-northwest to northwest. The landfill fire was located directly west of the E-BAM, based on the prevailing winds of west-northwest, the E-BAM may not have been located at the maximum point of impact. Concentrations of $PM_{2.5}$ gradually decreased with time.

The VOC sample did not indicate the presence of any abnormal (relative to landfill fires) VOC emissions. Overall, the observed measurements can be considered representative of air quality effects on adjacent neighbourhoods from the landfill fire.